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ATTORNEYS AT LAW

October 8, 2004

**Delivered Electronically**

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street, SW  
Washington, DC 20554

**Re: Reconsideration in the 70/80 GHz Band** (*WT Docket No. 02-146*)

Dear Ms. Dortch:

Over the past six months, members of WCA's Above 60 GHz Committee have had the opportunity to discuss WCA's pending petition for reconsideration in this proceeding with the Commission's staff. These meetings have been extremely productive, and we are grateful for the Commission's time and attention. There is, however, one issue that has not yet received the attention it deserves. We therefore hope in this letter to cast some further light on the "power/gain tradeoff" that the industry unanimously adopted and WCA advocated in its unopposed petition for reconsideration.

The Report and Order in this proceeding adopted a single set of power and antenna specifications for all applications in the 70/80 GHz bands: a minimum antenna gain of 50 dBi, a maximum EIRP of 55 dBW, and a maximum half-power beamwidth of 0.6 degrees. *Report and Order* at ¶ 96. By contrast, the industry proposed a half-power beamwidth of up to 1.2 degrees and a "sliding scale" approach to transmit power and antenna gain that would permit antenna gains as low as 43 dBi as long as each 1 dB reduction in gain (below 50 dBi) was "paid for" with a 2 dB reduction in EIRP. The rejection of this proposal in the Report and Order seems to have been based on concerns about interference and concerns about equipment cost.

In WCA's petition for reconsideration, we pointed out the Commission's antenna specifications would require manufacturers to use antennas with diameters of approximately 2 feet, which would in turn limit the number of towers on which such antennas might be placed. This affects not only the cost of installation in a new location, but also the number of existing locations that can accommodate 70/80 GHz antennas. *Petition for Reconsideration* at 15-16. We also stated that our technical simulations demonstrated that the Commission could adopt the industry's "power/gain tradeoff" "without significantly degrading the interference environment." *Petition for Reconsideration* at 16. However, our discussions with the staff have convinced us that we have not yet addressed the Commission's interference and cost concerns as directly and effectively as we should.

With respect to cost, we believe it is important to disentangle the power/gain tradeoff from the separate question whether Automatic Transmitter Power Control should be required by the Commission. Paragraph 96 of the *Report and Order* seems implicitly to assume that a relaxation in antenna gain would not be feasible without mandatory use of ATPC to regulate interference. See *Report and Order* ¶ 96 (stating that there are “more benefits from allowing more flexibility in the manufacturing of the transceivers, which contain more expensive hardware, than in the manufacturing of the antennas”). In fact, however, the simulations we have conducted show that the power/gain tradeoff is a good idea regardless of whether the Commission requires ATPC. Indeed, while all our simulations submitted for the record up until now have assumed the use of ATPC, new simulations described below show that the power/gain tradeoff is perhaps even more important if ATPC is *not* used.

With respect to interference, we understand the intuitive appeal of the idea that a narrower half-power beamwidth will produce less interference. However, computer simulations show this not to be true when narrower antennas transmit a higher EIRP. Over the summer, we submitted on several occasions graphs showing what would happen to the expected percentage of failed links if the Commission were to replace its current antenna and power requirements with the power/gain tradeoff and ATPC as endorsed by the industry. However, in order to show the benefits of the power/gain trade-off without ATPC, Cisco Systems Inc. ran new simulations the results of which are shown in Figure I. These results show that the power/gain tradeoff is even *more* important where ATPC is not in use.

## New Simulation Result with Exact Power/Antenna Gain Rule for Random

Cisco.com

### Power/Gain Rule Applied

Antenna Beamwidth (°)	Antenna Gain (dBi)	Max EIRP (dBW)	Max Tx Power (dBW)
0.6	50	55	5
0.8	47	49	2
1.2	44	43	-1

- Random deployment
- Maximum path length in accordance to link budget
- Simulations include Path Coordination, but no ATPC
- **Conclusion: power/gain trade-off provides more flexibility and lowers overall interference even without ATPC**

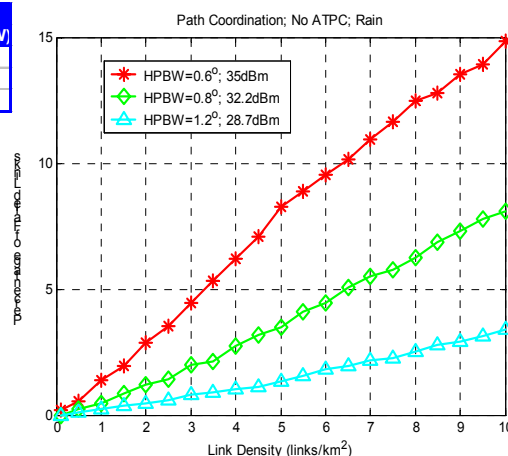


Figure I: Computer Simulation of Link Coordination Failure Probability for Random Deployments

As you can see from Figure 1, the expected failure rate for 0.6-degree beamwidths is *significantly* higher at *all* densities up to 10 links/km<sup>2</sup>; at 10 links/km<sup>2</sup>, the Commission's power and antenna requirements will lead to the failure of approximately 15 percent of all links while the industry's power/gain tradeoff would limit the failure rate to approximately 3 percent.<sup>1</sup> The same is true of hub-and-spoke deployments, as shown in Figure 2.

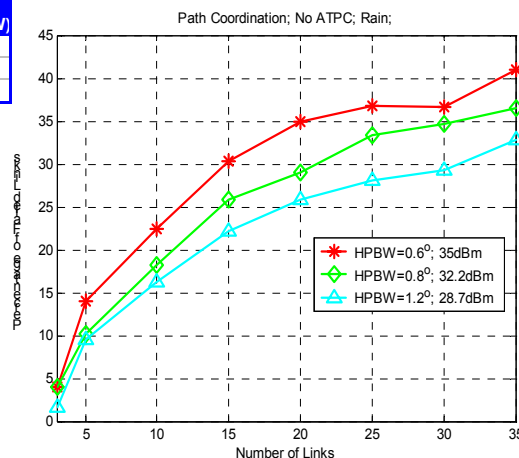
## New Simulation Result with Exact Power/Antenna Gain Rule for Hub-and-Spoke

Cisco.com

### Power/Gain Rule Applied

Antenna Beamwidth (°)	Antenna Gain (dBi)	Max EIRP (dBW)	Max Tx Power (dBW)
0.6	50	55	5
0.8	47	49	2
1.2	44	43	-1

- Hub-and-spoke deployment
- Maximum path length in accordance to link budget
- Simulations include Path Coordination, but no ATPC
- **Conclusion: power/gain trade-off provides more flexibility and lowers overall interference even without ATPC**



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Figure 2: Computer Simulation of Link Coordination Failure Probability for Hub and Spoke Deployments

<sup>1</sup> Sharp-eyed observers may note that the failure rates in Figure 1 are dramatically higher than in our earlier simulations. There are two differences between these simulations. The first is that we adjusted the transmitter powers to correspond to the *exact* power/gain trade-off we proposed rather than use the same transmitter power for all antenna beamwidths. Using the same transmitter power for all antenna beamwidths, which resulted in higher EIRPs for the narrower antennas, showed the wider antenna beamwidth did not increase harmful interference; this effect (wider beamwidth antennas cause less interference) is even more dramatic when the power/gain rule is applied. Compared to the previous simulation, applying the power/gain rule involved slightly increasing the transmitter power for the 0.6° antenna and slightly reducing the transmitter power for the 1.2° antenna (the transmitter power was about the same in both simulations for the 0.8° antenna); in the present simulation results, all transmitter powers and EIRPs are congruent with the maximum permissible levels per our proposed rule.

The second difference is that our earlier figures assumed the presence of ATPC and Figure 1 assumes the absence of ATPC. It is not the purpose of this letter to argue once again for the adoption of an ATPC requirement, but the new results reported in Figures 1 and 2 do confirm that the cost of not adopting such a requirement is quite significant.

These results may be counter-intuitive, but they have a relatively straightforward explanation that can be seen if we consider the overall radiation pattern in three parts: The far sidelobes, the near sidelobes, and the main beam. In each of these “regions” of the radiation pattern, the industry proposal results in a lower EIRP than the Commission’s mask, even though the half-power beamwidth is wider.

For the far sidelobes (5 degrees or more from centerline of main beam), the industry’s proposed rule provides for exactly the same suppression values as the Commission’s rule. However, a radio using maximum transmitter power with a 1.2-degree beamwidth would be using transmit power 6 dB less than a radio using maximum transmitter power with a 0.6-degree beamwidth. Since gain is constant in this region of the mask, the 6 dB reduction in power produces a 6 dB reduction in EIRP. Consequently, the overall potential for interference (which is a function of power *and* gain rather than either in isolation) is reduced with wider-beamwidth radios.

For the near sidelobes (from 1.2 to 5 degrees from centerline of main beam), the industry proposed a suppression value of  $G-28$  dB where  $G$  is the gain of the antenna in dBi. However, once again, a radio with 1.2-degree beamwidth that takes advantage of the power/gain tradeoff in this region will have an EIRP that is up to 6 dB below that of a radio that operates at the Commission’s specified power and gain with a 0.6-degree beamwidth. This can be seen by the following:

- 50-dBi gain antenna: minimum suppression is  $50 - 28$  dB or 22 dB. So the antenna gain is 50 dBi – 22 dB, or 28 dBi from 1.2 to 5 degrees from centerline of main beam; since the transmitter power is 5 dBW, the EIRP is 33 dBW.
- 44-dBi gain antenna: minimum suppression is  $44 - 28$  dB or 16 dB. So the antenna gain is 44 dBi – 16 dB, or 28 dBi from 1.2 to 5 degrees from centerline of main beam; since the transmitter power is -1 dBW, the EIRP is 27 dBW.
- If the two radios are operating at less than the maximum power (so that the reduction in gain does not require a 2-for-1 reduction in power), the EIRPs are equal. For example, with transmitter power of -10 dBW, either antenna pattern will produce an EIRP of 18 dBW in this “near sidelobe” region.

Finally, in the main beam (less than 1.2 degrees from centerline), a radio using a half-power beamwidth of 1.2 degrees will have given up enough compensating transmitter power to make its EIRP up to 12 dB lower than for a radio with a 0.6-degree beamwidth. Interference will therefore be lower in this region as well. And again, this comparison holds even when transmitter power is less than the maximum. For example, with transmitter power of -10 dBW, the radio using a half-power beamwidth of 1.2 degrees will have 44-dBi gain antenna and an EIRP of 34 dBW; a radio using a half-power beamwidth of 0.6 degrees will have 50-dBi gain antenna and an EIRP of 40 dBW. Therefore, the 0.6-degree beamwidth radio produces greater interference (by 6dB).

In conclusion, our previous description of the power/gain tradeoff as a preferred way to increase operational flexibility “without significantly degrading the interference environment,” Petition for Reconsideration at 16, was crafted for an environment in which all radios use ATPC. In a non-ATPC environment, our description would be a significant understatement, for the power/gain tradeoff leads to an *unambiguous improvement in the interference environment*, without imposing any additional costs on radio manufacturers. Based on this new information, we hope the Commission will agree that the power/gain tradeoff should be adopted on reconsideration regardless of what happens to ATPC.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Mark A. Grannis", followed by a horizontal line.

Mark A. Grannis